

PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

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PROFESSOR ROBERT COLLETT ON *PTERYCOMBUS*  
*BRAMA* FRIES.

BY R. W. SHUFELDT.

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Nearly twenty-five years ago the present writer published in the *Journal of Morphology* a paper entitled "Further Studies of *Grammicolepis brachiusculus* Poey" (Vol. II, No. 2, Nov., 1888, pp. 271-296, figs. 1-14). This paper consisted in a translation and republication of Professor Poey's description of that very remarkable, and, so far as known at this writing, unique form of fish.\* My contribution considerably augmented the valuable paper just cited, especially in the matter of osteological comparisons made with the skulls and parts of the vertebral columns of other species of fishes. These were recommended by Doctor Theodore Gill, who kindly furnished me from his own collection material for the purpose. The Smithsonian Institution also loaned Dr. Gill additional specimens for the purpose, which were forwarded to me at Fort Wingate, New Mexico, where I was serving as Post Surgeon at the time, and where I studied and wrote out my account of *Grammicolepis*.

As Professor Poey believed that the species was more nearly related to the *Carangidae* than any other family of fishes known to him, most of my material for comparison belonged to that group, as, for example, skulls and other bones of *Caranx hippos*, *Teuthis caeruleus*, *Pomacanthus paru*, and a few others. The skulls of some of these I figured and published in my article, particularly the three species just given. There was one fish, however, that I especially desired to compare with *Grammi-*

\* *Anal. de la Soc. Esp. de Hist. Nat.*, Fom. 11, 1873, by Felipe Poey.

*colepis* and that was the common "Pomfret" from the coast of South America and elsewhere. This fish belongs to the family *Bramidae* and is known to science as *Brama raii*, and I regret to say that up to the present writing no example of it has ever been in my possession for anatomical or other examination. Poey had already pointed out the presence of the long vertical linear scales in *Grammicolepis*; these also occur in *Brama*, though they are much shorter and principally evident in the mid-lateral area. However, apart from the decidedly forked tail and small eye of *Brama*, there are at least some points in the external appearance of the latter to remind us of *Grammicolepis*.\*

In going over my collection of author's ichthyological reprints lately, I met with a copy of Professor Robert Collett's valuable contribution on *Pterycombus brama*, which was published in the Norwegian language some twelve years ago.† This paper with its two plates throws not a little light on the morphology of both *Grammicolepis* and *Brama*, and upon this account, if no other, it is quite worthy of a translation into English. Dr. Collett writes me that it has never been so rendered, as far as he is aware. By the aid of my camera I have copied, and herewith reproduce, the two plates illustrating it.

My translation of the original contribution is as follows:

Through the courtesy of curator Storm, of the Museum in Trondhjem, I had the opportunity in the summer of 1895 to examine a recently captured, and very well preserved, specimen of *Pterycombus brama*, taken upon the coast of Nordland during the spring of the same year. As the Museum of the University of Christiania had already in its collection three examples of the same species,‡ and as I at the same time, through

\* This may be appreciated by comparing my figure of *Grammicolepis* and the one of "*Brama raii*," plate 112 of Goode's *The Fisheries and Fishery Industries of the United States*, 1881. It will be noted, that in the case of *Brama* the low dorsal fin is continuous and the pectoral fin long and acute, which is not like what we find in the form described by Poey.

† COLLETT, R. *Om Pterycombus brama* Fries, Bergens Museums Aarbog, 1896. No. VI, with two plates. One of these latter presents a right lateral figure of the species, and the other a left lateral figure of its entire skeleton.

In conversation with Dr. Tarleton H. Bean I am told that a translation of this paper would be of great value to such students of ichthyology as were unable to read the work in the original. This translation has been kindly made for me by Miss M. U. Overland, of New York City, a translation that, so far as my labors were concerned, merely required a transcription into the language of science. Doctor Bean further informs me that there are no specimens of *Pterycombus brama* in the United States, so far as he is aware.

‡ One in alcohol, one dried, and one skeleton.

the courtesy of Dr. Brunchorst, have received for examination the two specimens at present contained in the Bergen Museum, I will here offer a few remarks on this remarkable species.

Several descriptions of *Pterycombus brama* have appeared and consequently the external appearance of this form, in so far as its principal characters are concerned, is known, notwithstanding the fact that none of the descriptions has been made from either fresh or uninjured specimens.

Originally the species was described by Professor B. Fries in 1837, from a dried specimen obtained by the State Museum in Stockholm, and the general characters in this description, given by that excellent ichthyologist, accompanied as it is by a photograph of the dried specimen, are quite fully presented (1). Professor Fries placed this new form in the family *Scombridae*, and considered it as being most nearly related to *Pteraclis* Gronov., a genus which later on, and for better reasons, has been relegated to the family *Coryphænidae*.

In 1855, Professor Nilsson, in his *Scandinavian Fauna*, gave a new description of the same specimen, which he had examined during the previous year in the State Museum (2). Nilsson here, for the first time, pointed out its close relationship to *Brama* Schneider, and he referred both to the *Squamipinnes*, a group represented by species having a number of external characters in common with them, including the partly scale-covered fins.

The next author treating of this genus is Professor Lilljeborg, who, in 1865, in his letter of invitation to the Upsala Re-union on November 4, 1864 (published simultaneously in the Year Book of the Upsala University for 1865), made some observations based upon six other specimens obtained in Norway during recent years, which the author had the opportunity of examining in 1861 in the Museums of Bergen and Christiania (3). A supplemental description is given of one of the specimens in the collection of the Bergen Museum (taken near Bergen); Lilljeborg here correctly points out that the relationship of *Pterycombus* (and *Brama*) to the *Squamipinnes* is only an apparent and not a real one. He is inclined to consider that these species more likely constitute an aberrant group falling within the family *Scombridae*, with only certain affinities with the *Squamipinnes*.

In a paper read at the Congress of Naturalists in Christiania in 1868, on the Fishes of Finnmarken, Professor Esmark was the next one to announce the discovery of another specimen, which had been sent to the Museum of the University from the fjord of Varanger in 1866 (4).

When I published my *Fishes of Norway* in 1874, ten specimens were recorded of this species as having been taken on the coasts of Norway (5). Later on, or in 1879, in the first supplement to this work (6), the added information was given of an eleventh specimen, it having been taken at Hammerfest in 1877, and in 1884, in the second supplement (8), reported the taking of the twelfth specimen which was obtained at Egersund in 1880. However, as one of the earliest accounts has proved to be unreliable, it is safe to say that only eleven specimens is the correct number known.

A very interesting observation was made in 1880 in regard to this

remarkable form by Professor Lütken. It occurs in that volume of "Spolia Atlantica" in which he describes the various stages of development in the young of the pelagic Acanthopterygians (and of *Scombresox*), and he there presents (7) illustrations and descriptions of a very young fish taken from the intestine of an "Albacore" (*Thunnus alalunga*) in Lat. 8° N. Long. 24° W., that is to say, a little to the southward of the Cape Verde Islands. The length of this specimen was twenty-two millimeters.

This young fish, although found in the tropical zone of the Atlantic Ocean, is nevertheless considered by this author as belonging to *Pterycombus*, and possibly a specimen of *Pterycombus brama*, a species hitherto considered as occurring only in the subarctic seas. Should this conjecture be confirmed through the discovery later of adult specimens, it would go to prove that the species is not confined to the seas of the North, but is rather to be considered as having a wider range, extending even to the deep seas of the middle and north Atlantic; and that occasionally it may have been carried out of its habitat through the agency of the warmer ocean currents, and thus have strayed to the northern coasts.

In the paper just cited, Professor Lütken places *Pterycombus* in the family *Bramidæ*. Gill, in 1872, in his "Arrangement of the Families of Fishes" (Smiths. Miscell. Collect. No. 247, Washington, Nov., 1872) had already divided the *Coryphænidernes* into several families of which the *Bramidæ* and the *Pteraclididæ*, which contain respectively *Brama* and *Pteraclis*, were two; in 1892, Jordan and Gilbert, in their "Synopsis of the Fishes of North America" (Bull. U. S. Nat. Mus., No. 16, Washington, May, 1882) places both of these genera in the family *Bramidæ*, and which, according to Professor Lütken, includes the genus *Pterycombus*.

In his "Scandinavian Fauna: Fishes" (9), Professor Lilljeborg in 1891 next gives us a new and revised description of this form, in which its specific characters are most clearly determined. Here the species is still retained in the family *Coryphænidæ*.

In 1892 Professor Smitt, in the revised edition of Wright, Ekström and Sundevall's "Scandinavian Fishes" (10) invites attention to the close similarity in the matter of the Morphology of the scales in *Pterycombus* (and *Brama*) as compared with the Pycnodonts from the Liassic,\* the latter being a group distinguished by its peculiar pleurolepine scales arranged in rib-like rows, the nature and structure of which has not, as yet, been fully determined.

In his account of this species, Smitt, who at the time had before him only two dried and imperfect specimens, gives us an exhaustive description of the scales and the fins.† In addition to the illustration showing

\* WOODWARD, Cat. Foss. Fishes, Brit. Mus. Pt. III, p. 189, Lond., 1895.

† In his differential diagnosis of the two genera *Pterycombus* and *Brama*, he mentions (as did Lilljeborg in his above cited paper of 1891) the fact, and refers to it as an important character, that the skin on the unpaired fins is scaleless in *Pterycombus*, but is scaled in *Brama*. This is not invariably the case in well-preserved specimens of *Pterycombus* where we meet with a row of minute scales on the skin between the spines of the anterior portion of the fins, and in the case of the caudal fin, along the upper and lower rays.

the scales on the body, Fries's original figure of the dried Type-specimen is here reproduced.

Finally, this genus is dealt with by Struxberg in his recently published "Fish Fauna" (11), and his description is accompanied by a reduced reproduction of Fries's figure already referred to above.

Since 1834, then, when the first specimen of this genus was secured by the Government Museum in Stockholm from Finnmarken, and was there described by Fries in 1837, 13 specimens at least have been taken on the coasts of Norway and have been preserved.\* Of these one specimen, according to the account given by Professor Lovèn, has already been sent to France;† together with the type-specimen, one has been sent to the Museum at Stuttgart; the remaining specimens are all preserved (with the exception of one which has been lost trace of) in the various Museums of Norway, in Stockholm and in Upsala.

With the exception of three, all of these 13 specimens were taken in the arctic seas, or along a stretch of coast-line extending from Tromsø and Altenfjord up to Varangerfjord. Of the remaining ones, one came from Nordland, one from the reefs off Bergen, and one from Egersund.

These widely separated points of capture, extending from the southernmost point of Norway to the Russian boundary, would appear to confirm the above made suggestion, that *Pterycombus brama* is a pelagic rather than a true arctic species.‡

FINMARKEN.

|   |                                   |
|---|-----------------------------------|
| Hammerfest (prior to 1834) (dried) . . . . .    | Government Museum Stockholm.      |
| Altenfjord (prior to 1837) . . . . .            | One to France.                    |
| Finnmarken (prior to 1861) . . . . .            | Bergen Museum                     |
| Finnmarken (prior to 1861) . . . . .            | sent to Bergen Museum. (Skeleton) |
|   | Univer. of Christiania.           |
| Finnmarken (prior to 1861) . . . . .            | sent to Bergen Museum. (Dried)    |
|   | Upsala Museum.                    |
| Finnmarken (prior to 1861) . . . . .            | sent to Bergen Museum. (Dried) ?  |
| Varangerfjord (prior to 1861) (Dried) . . . . . | Univ. Museum Christiania.         |
| Varangerfjord, October 29, 1866 . . . . .       | Univ. Museum Christiania.         |
| Hammerfest, November 28, 1877 . . . . .         | Tromsø Museum.                    |

\*It is evident that this fish has been found much oftener and not preserved. Frequently specimens have come into the hands of fishermen, who were unfamiliar with it, but whose descriptions point to the fact of there having been examples of either *Pterycombus* or else *Brama*, and these specimens have been thrown away by their captors as valueless. As an example of this, we know of such a specimen having been taken at Andenes in Vesteraalen in 1876, and still another at Alstens in Helgeland (Nordland) in December, 1877.

†FRIES, Kgl. Vet. Acad. Handl., 1837, p. 15.

‡In 1868 Professor Esmark (Forh. Skand. Naturf. Møde i Chra. 1868) (Proc. of the Cong. of Scandinavian Naturalists at Christiania, 1868, p. 522) states that: "to my knowledge, seven specimens in all have been received by the University." What he probably meant to convey here is—instead of the University—all the Museums of the country, for I meet with no proof that the collection of the University ever contained more than the three specimens named above.

## COAST OF TROMSÖ.

Nord-Reisen, October, 1895 . . . . . Mus. Stuttgart.

## COAST OF NORDLAND.

Alderen, April, 1895 . . . . . Trondhjem Museum.

## COAST OF BERGEN.

Bergen (prior to 1861) . . . . . Bergen Museum.

## SOUTHERN COAST OF NORWAY.

Egersund, 1880 . . . . . Stavanger Museum.

The eight (nine?) specimens which are now contained in the various museums of Norway measure as follows:

(Measurements in millimeters.)

|               |       | Total length. | Length to the last caudal vertebra. | Height of body (with-out fins). | Length of head. |                      |
|---------------|-------|---------------|-------------------------------------|---------------------------------|-----------------|----------------------|
| Varangerfjord | 1866. | 370           | 295                                 | 121                             | 75              | Univ. Mus. Chris. a. |
| Varangerfjord | 1861. | 370           | 298                                 | 120                             | 75              | “ “ “                |
| Nordland      | 1895. | 375           | 290                                 | 143                             | 83              | Trondhjem Museum.    |
| Hammerfest    | 1877. | 380           | 293                                 | 117                             | 77              | Tromsö Museum.       |
| Finmarken     | 1861. | 395           | 320                                 | 130                             | 80              | Bergen Museum.       |
| Egersund      | 1880. | 410           | 315                                 | 150                             | 88              | Stavanger Museum.    |
| Bergen        | 1861. | 411           | 318                                 | 137                             | 85              | Bergen Museum.       |
| Nord-Reisen   | 1895. | 455           | 349                                 | 175                             | 90              | Museum at Stuttgart. |
| Finmarken     | 1861. | 465           | 339                                 | 160                             | 100             | Univ. Mus. Chris. a. |

It will be observed that the total length of the specimens varies from 370 millimeters to 465 millimeters,\* and all of the specimens were apparently adult. The two specimens in the Swedish Museums are of the same size as those just given.

The majority of the specimens of which we have any data were found floating on the surface of the water, and either dead or in a dying condition; others are beach specimens, having drifted ashore. One example, it is said, was taken by hook and line at a depth of a couple of hundred fathoms, some three miles west of Bergen, and still another (Varangerfjord 1866) was captured in a salmon net, set in rather shallow water, and only a few feet below the surface. This specimen was probably about to drift ashore. This last-named example was a male with enormous testes; the intestine contained, besides slime, a number of hard and transparent spiculae of unknown composition, as well as numerous small *Scolices*.†

\* In the "Fishes of Norway," 1874, the total length of the specimen taken in Varangerfjord in 1866, is, through a typographical error, given as 350 instead of 370 mm.

† Dr. Einar Lönnberg has been kind enough to examine these last. He is of the opinion that they are specimens of "*Scolex polymorphus*" under which name he assumes that the larvae of the genera of *Acanthobothrium* are included.

Since 1880 but two specimens of this species have been found on the coasts of Norway, both in 1895.

One of these was found floating on the surface of the water about the middle of April, 1895, at Alderen (coast of Helgeland, Nordland), and was sent to the museum in Trondhjem. The other was found in Nord-Reisen in October, 1895, and was sent to the Tromsö Museum, which in turn donated it to the Royal Natural History Collection in Stuttgart, where it is now to be found.

The first-named of these specimens I had an opportunity to examine in the Trondhjem Museum in July of the same year, was in excellent condition, and so well preserved that the natural colors still persisted nearly throughout. It was apparently adult, and of an average size. Its measurements were as follows: Total length, 375 mm. Length to the tip of the middle caudal ray, 323 mm.; to the distal end of the spinal column, 290 mm. Height of the body (to the terminal line of the scales), 158 mm.; to the base of the rays, 143 mm. Length of head, 83 mm. Diameter of an orbit, 32 mm. Diameter of postorbital depth of head, 35 mm. Length of premaxilla, 42 mm.; mandible, 29 mm. Longest of the dorsal rays (the 21st), 135 mm.; longest of the anal rays (the 6th), 130 mm. Length of the pectoral fin, 86 mm.; the ventral, 24 mm.

COLOR: Portion above the lateral line is a brilliant steel-blue, showing in iridescence green and purple tints; below the lateral line the body is of a silver color. The rays of the dorsal and anal fins are whitish until they approach the apices; the entire membrane is black.

The pectorals are uniformly yellowish white, semi-transparent, while the superior margin of this fin is black (the 2d ray). At the base of the fin next to the body the pectoral is of a blue-black. The ventral fins are entirely black with the mesial apex whitish and transparent. Sclerotic above, bluish black. Iris light (whitish yellow?).

The number of the rays was as follows: Dorsal, 9 | 44; Anal, 3 | 39; Ventral, 1 | 5; Pectoral, 2 | 18.

The lateral line possesses 48 scales (of these 21 to the apex of the pectoral); of the spiny-pointed scales there were found on this specimen only 11 rows; the 5-6 rows nearest the ventral line, and 3-4 nearest the dorsal line being almost smooth.

Of the second specimen (the one from Nord-Reisen above Tromsö) which was sent to the Stuttgart Museum, I have, through the courtesy of Professor Lampert, obtained some measurements of, which are given in the table above.

As stated above, the Museum of the University of Christiania possesses a skeleton prepared from a specimen received from Finnmarken (in the 50's). The total length of this skeleton is 445 mm. (The specimen when fresh measured 465 mm.)

In its skeletal characters *Pterycombus* comes nearest *Brama*, but it departs from that species in a number of osteological details or characters, especially in the morphology of the spinal column. The massive development of the ribs is particularly striking, the neural spines and the dorsal

interspinals form together an almost solid perpendicular wall of bone, which is entirely different from anything known as pertaining to the other genera of the Scombroids. In this respect it so far departs from what we find in its apparently nearest relative *Brama*, that it should probably be placed in a family by itself.

The *cranium* departs but slightly from what we find in *Brama*,\* is proportionately higher and shorter than in *Brama*, the height here being greater than the length. The lofty fronto-occipital crest so characteristic of *Brama*, *Lampris*, *Coryphæna* and the majority of the *Scombroidea*, and which in the first-named attains a height which about equals the diameter of the orbit, is in *Pterycombus* low and short. It arises here posterior to the anterior margin of the orbit in the frontal region (consequently completely posterior to the ethmoid) about midway between the first interspinal and the premaxilla. The greatest height of the crest, which is about opposite the middle of the orbit, is only one-fourth the diameter of the latter. This crest is formed almost entirely by the frontals, the supraoccipital making up but a very small portion of it; that part between the first interspinal and the posterior margin of the supraoccipital is triangular in outline, membraneous in structure and is found above the occipital bone. The level area, which is seen on the superior aspect of the cranium, which the supraoccipital and frontals together form, and from which the crest arises, is in *Pterycombus* relatively short, its entire length being about equal to the orbital diameter. It exhibits but a few rugose lines which radiate from a point directly beneath the center of the supraoccipital crest, or the frontal crest, and pass directly outward to the margins. In *Brama* this surface is considerably longer, almost twice as long as the orbital diameter, and exhibits a couple of raised longitudinal lines which pass in an anterior direction.†

POST-TEMPORAL, Parker, (*Supra-Scapula*, Owen), is bifurcated as in *Brama*; either fork is broad and flat, without any elevations or lateral processes at the base of the superior limb.

\*In the specimen of *Pterycombus* before me, the entire hyoidean apparatus is missing.

†The more I study Professor Collett's skull of *Pterycombus* (herewith reproduced) and his description of that part of the skeleton in *Brama*, and compare both with my figures and descriptions of the corresponding structure: in *Grammicolepis*, the more I am inclined to believe that *Pterycombus* and *Grammicolepis* are related genera, with *Brama* not very far removed. Further, there seems ground to believe, that in the case of all three of these genera of fishes, each is a representative of a separate family. Two of them have already been established, as the *Bramidae* and the *Grammicolepidæ* (Poey), and, unless some other naturalist has already done so, it would seem that *Pterycombus brama* represents a group having similar rank,—that is, the family *Pterycombidæ*. Professor Poey was of the opinion that the *Grammicolepidæ* came nearer to the *Carangidæ* than any other family known to him at the time he established the former, and I was disposed to concur in his opinion; but since reading Collett's paper, I am inclined to think otherwise, and adopt what would appear to be a most natural arrangement, or the one above suggested. All three would appear to be related by a variety of characters more or less closely with the *Berycidæ*; the *Balistidæ*; *Acanthuridæ*, and the *Scombridæ*, especially the last-named.

The skeletal and other characters given above by Professor Collett found in *Pterycombus brama* are ample, in my opinion, to justify the establishment of the family *Pterycombidæ*. R. W. S.



SUPRACLAVICLE, Parker, (Scapula, Owen), is rather long and narrow; the width (9 mm.) being equal to one-fourth the length (36 mm.).

POSTCLAVICLE, Parker, (Epicoracoid, Owen), is normal, with long styli-form process.

CORACOID, Parker, (Radius, Owen), which in *Brama* is large and of broad oval outline, suggesting the immense coracoid in *Lampris*, is here in *Pterycombis* much narrower and directed more anteriorly. Its length in the specimen now being examined is 53 mm., the greatest width 20 mm. Along its mesial margin it is formed partly in membrane, and exhibits a little below its center an oval notch, which is quite circular in *Brama*. Just within its outer margin two elevated longitudinal rays radiate from the actinosts; the superior one, which is the smaller, is quite short, while the lower one, which passes somewhat internal to the margin of the bone, is continued almost to its anterior end. The PELVIC GIRDLE is small, slender but otherwise normal.

RIBS. These number 23, of which twenty of the posterior pairs exhibit an unusual development. They are broad, hollow, and together form a bony wall without interstices, as each rib is so broad that its posterior margin overlaps the edge of the rib next behind it. They are relatively short, being attached to the downwardly produced apophyses in such a manner that their truncated superior parts reach to the center of the vertebre.

FIRST RIB is articulated with the third vertebra, and is short, being only slightly broader at its head than it is at its free extremity (therefore about normal). *Second* and *third ribs* are somewhat broader at their articular ends, but are rapidly reduced in size as the free ends are approached, finally terminating in an elongated delicate ventral extremity.

The *fourth* to the *twenty-third ribs* are very characteristic. A typical one, the eighteenth, is here shown in the cut, and may be described as follows: The vertebral extremity, which is intimately articulated at the external aspect of the parapophysis, is almost square or cubical in form, and is hollowed out up as far as its head. This excavation is continued as a groove for a little distance down along the internal border of the rib, and thereafter terminates in a long, extremely attenuated free ending. At its broadest part the superior excavation is nine millimeters broad, measured in the antero-posterior direction, while its thickness internally is rather less than 5 mm.; its height (13) somewhat exceeds its width, and constitutes not quite one-third of the entire length of the rib (44 mm.).

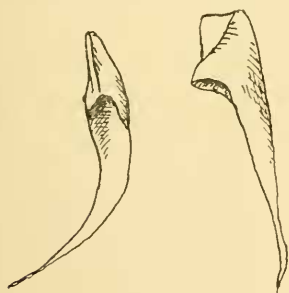


Fig. 1.  
Ribs of *Pterycombis brama*.  
(Nat. size.)

In the *five posterior pairs of ribs* the postero-superior angle of the excavation is produced as an apophysis, flexed caudalwards, and which is, particularly on the ultimate rib, long and slender, projecting outward

over the 25th vertebra. The last two pairs of ribs articulate with the parapophyses of the 24th vertebra.

There are *fifty vertebrae* in the spinal column, of which 24 are thoracic and 26 caudal. The body of the *first vertebra* is rudimentary, while its neural spine is well developed. The ribs articulate with the third to the twenty-fourth vertebrae inclusive.

The neurapophyses (neural spines) are remarkably robust and broad, especially in the thoracic region, where at their bases they have a longitudinal diameter almost equal to the length of the body of the vertebra to which any particular spine is attached. (See Plates.)

For this reason, these neurapophyses almost come in contact with each other, anteriorly and posteriorly, at their bases. As we pass backward, these neural spines of the thoracic vertebrae become more slender, although in this part of the spinal column the distance between them, at their bases, is less than their own longitudinal diameter, in the case of any two contiguous spines. In the caudal region they become more and more slender as we approach the tail, though still stouter than we find them in *Brama*.

The first and second neural spines are vertical, or inclined slightly forward, the remaining ones are as we usually find them.

The most lofty ones are met with on the ultimate thoracic vertebrae (37 mm.).

The *parapophyses* of all the rib-bearing vertebrae are directed downward, and each has a length somewhat exceeding the depth of the body of the vertebra to which any particular one belongs. The parial parapophyses of any vertebra in the abdominal region fail to come in contact mesially, and therefore do not form true hæmal arches.

On the caudal vertebrae the hæmal spines are at once greatly produced; the one on the leading caudal vertebra possessing a length of 45 mm. Their antero-posterior diameters at their bases equal those of the corresponding neural spines in any particular vertebra, and as we proceed backward the amount of reduction in point of size is also nearly proportionately coequal.

*Secondary ribs* ("Scleral-Spine": supplemental or auxillary ribs) are to be found on all the anterior vertebrae of the spinal column until we reach the second or third ultimate abdominal ones, where there is not the slightest trace of them in the specimen at hand.

On the first and second vertebrae they are attached to the hæmal arch; on the third to the seventh they articulate with the centrum of the vertebra ("Corpus:" "*Epicentralia*"); on the remaining vertebrae with the anterior surface of the superior border of the rib ("*Epipleuralia*"). These *auxillary ribs* attain their greatest length (20 mm.) in the mid-series of the thoracic region, where they about equal the length of four of the centra of the vertebrae.

The *interneural spines* (the dorsal interspinal bones), are immense, very broad, and so close together that they are in contact with each other along their entire lengths, thus forming an almost continuous plate of bone in the anterior region of the spinal column.

The eight leading ones which support rudimentary rays are all anterior to the first neural spine, and are in immediate contact with the supra-occipital bone, forming with it, superiorly, a solid crest, the base-line of which (23 mm.) is one-third less than the height.

Those next succeeding possess the same breadth and length as the leading ones, and are quite as close together; but as we proceed backward, the distance between them becomes slightly increased, and it is only after we arrive at the posterior abdominal ones that they become decidedly narrower and of a size less than the distance between any two of them. In the caudal region they become progressively and rapidly reduced in both the matter of length and size, until we reach the tenth and twelfth caudals, where they are almost rudimentary in character. They exhibit their greatest length (43 mm.) over the anterior thoracic vertebræ, where they are almost twice as long as the neural spines opposite them, with the apices of which they come in contact.

*Interhæmal spines* ("the ventral interspinal bones") are all slender and rather short; they possess their greatest length beneath the anterior caudal vertebræ, but even here they are, for the series, shorter than the corresponding hæmal spines.

The *dorsal rays*, 53 in number, in the specimen before me, start at once over the leading interspinals; the first eight, whose corresponding interspinals surmount the superior aspect of the skull and precede the first neural spine, are short.

There are 41 *anal rays*.

The *Pseudobranchiæ*, with a length of 16 mm. are well developed.

The *Gills*: The leading arch is supplied with a mesial row of "teeth," eight in number, and about 6 mm. in length; they extend from a point almost directly beneath the orbits, and are continued forward as mere tubercles to the apex of the arch.

The lower or *inferior pharangeals* likewise support (5) minute tubercles. Upon the remaining *branchial arches* we find no true "teeth," but only rudimentary tubercles in place of them.

#### THE LITERATURE OF *PTERYCOMBUS BRAMA*.

(Translated.)

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EXPLANATION OF PLATES.

*Plate I.*

Right lateral view of *Pterycombus brama*, Fries.

*Plate II.*

Left lateral view of the articulated skeleton of *Pterycombus brama* Fries. Both plates by Shufeldt after Collett.